Lori S. Glaze, Ph.D.
NASA Planetary Science Division Director

PAC Meeting
August 17, 2020

Welcome to the team!

Courtney O'Connor

Jeff Gramling

Christy Layton

Bo Trieu

Megan Ansdell

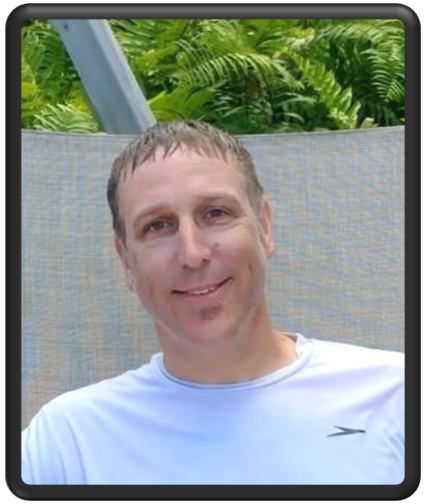
David Smith

Lindsay Hays

KC (Kenneth) Hansen

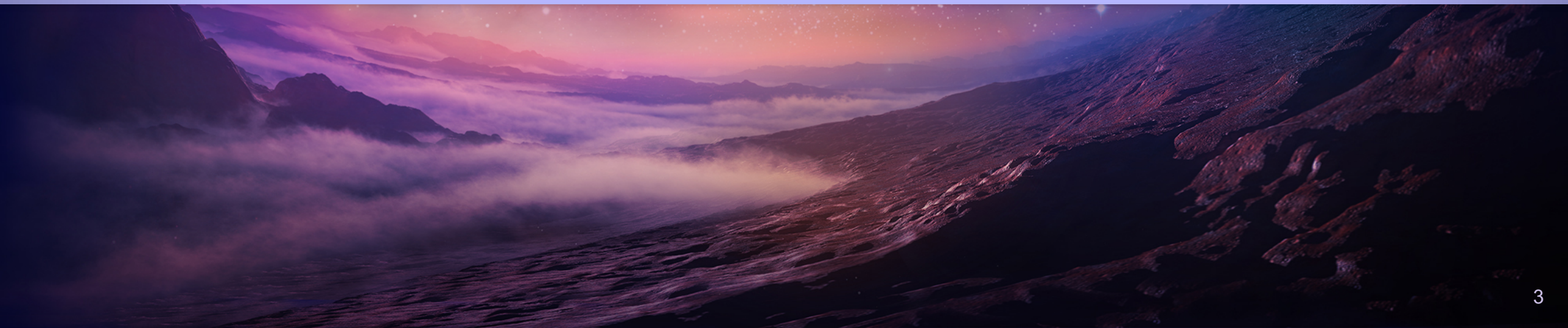
Rich Ryan

Amanda Nahm



Aaron Burton

COVID-19



COVID and PSD

Current top priorities

- Everyone’s health and safety
- Protecting hardware and integrity of data for operating missions
- Continued work on DART and Lucy

Ongoing challenges

- Full-time telework; learning how to successfully conduct our work in a virtual environment
- Balancing work and other responsibilities
- Building and nurturing relationships with the community and our teams—especially with new colleagues

COVID & the Planetary Science Community

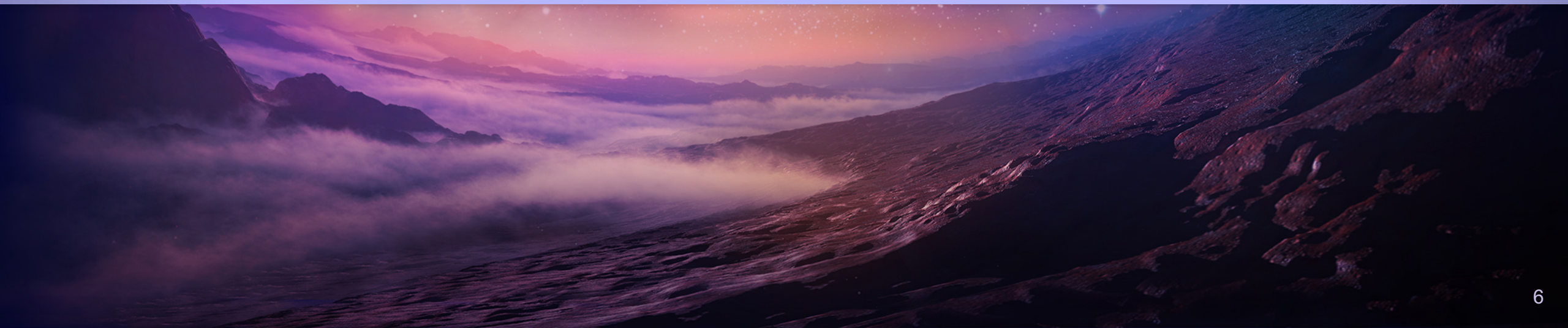
Concerns

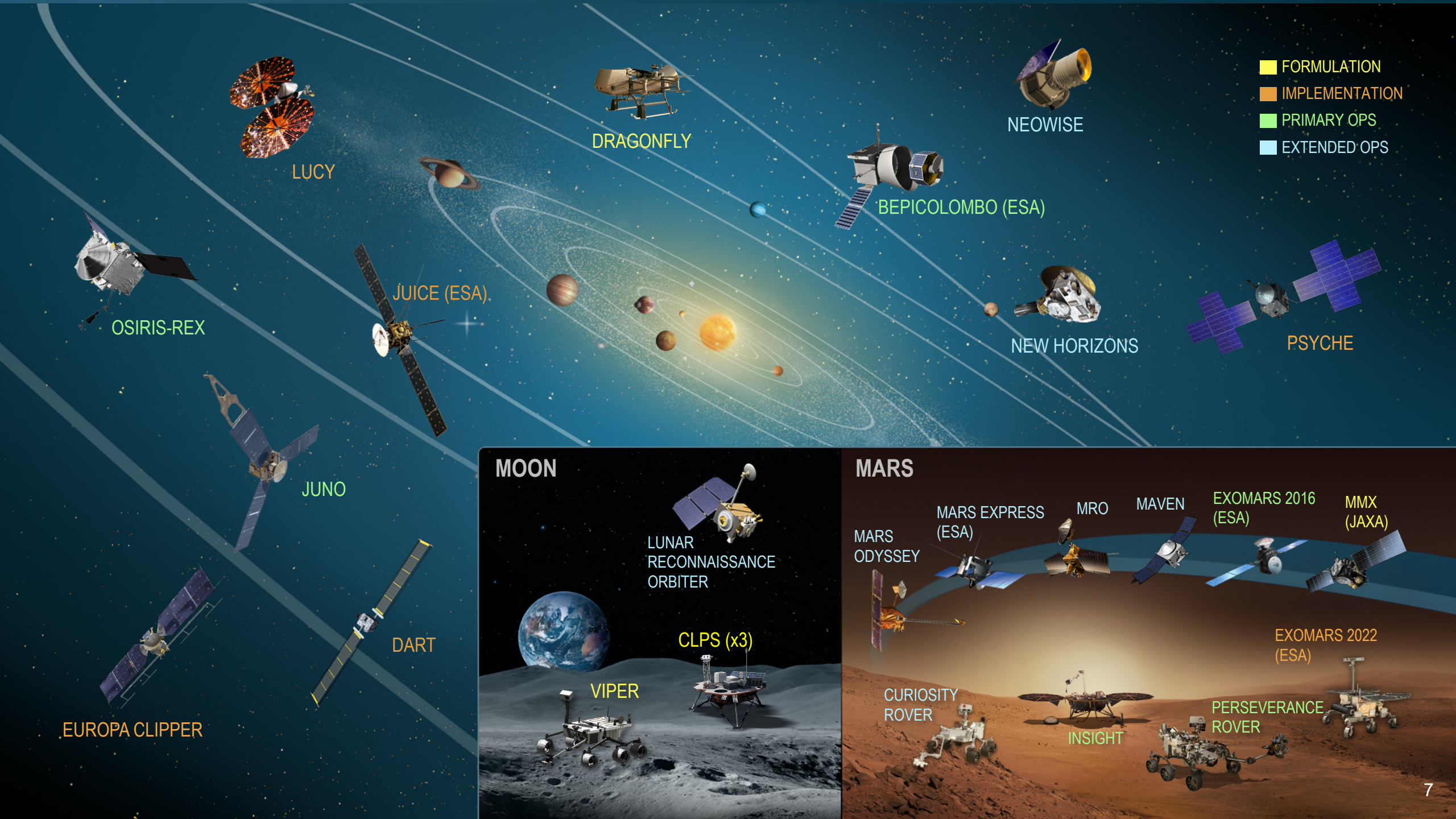
- Short-term: how to ensure diverse and representative input to our processes and work (e.g., proposals, reviews, Decadal Survey)
- Longer-term: we will lose a large fraction of new planetary scientists because of economic fallout

Initiatives

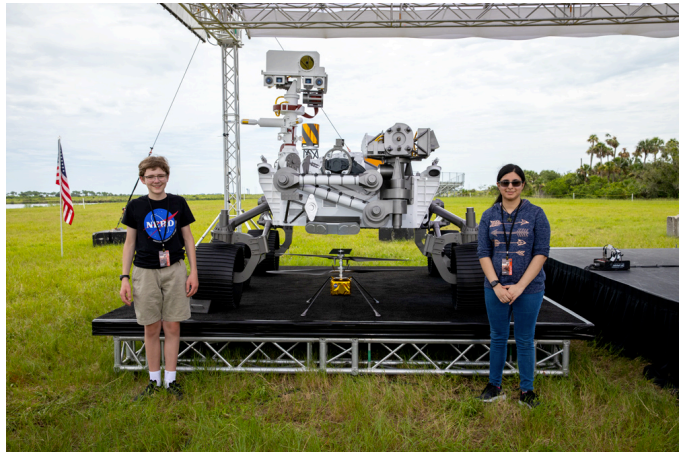
- Requests for augmentations and funded extensions to existing SMD-funded grants
  - Prioritized to help graduate students and postdocs; soft-money, early-career researchers
- Investigating expansion of NASA Postdoctoral Program and creating new, short-term positions at NASA Centers
- Statement of Task sent to Space Studies Board of NASEM to address topic of increasing diversity and inclusion in the leadership of competed space missions
- In-person PI Launchpad events suspended:
  - Investigating options for virtual workshops tied to upcoming conferences
  - Information and materials from first event available: https://science.nasa.gov/researchers/pi-launchpad

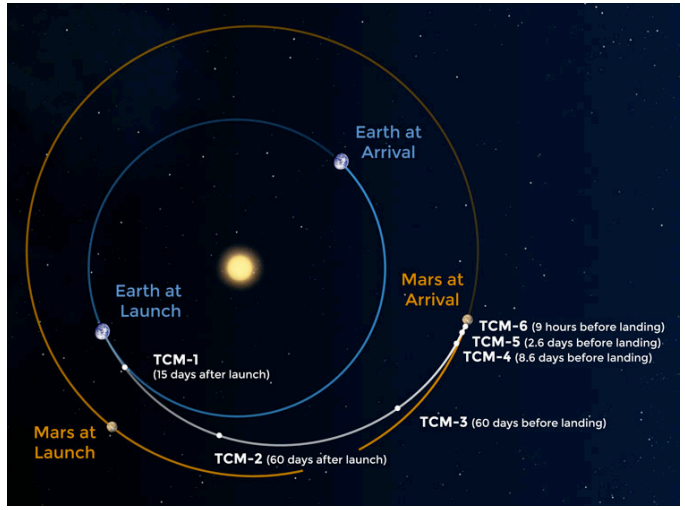
Current Status




FORMULATION
IMPLEMENTATION
PRIMARY OPS
EXTENDED OPS
LUCY
DRAGONFLY
NEOWISE
BEPICOLOMBO (ESA)
OSIRIS-REX
JUICE (ESA)
NEW HORIZONS
PSYCHE
JUNO
DART
EUROPA CLIPPER
MOON
LUNAR RECONNAISSANCE ORBITER
CLPS (x3)
VIPER
MARS
MARS ODYSSEY
MARS EXPRESS (ESA)
MRO
MAVEN
EXOMARS 2016 (ESA)
MMX (JAXA)
EXOMARS 2022 (ESA)
CURIOSITY ROVER
INSIGHT
PERSEVERANCE ROVER

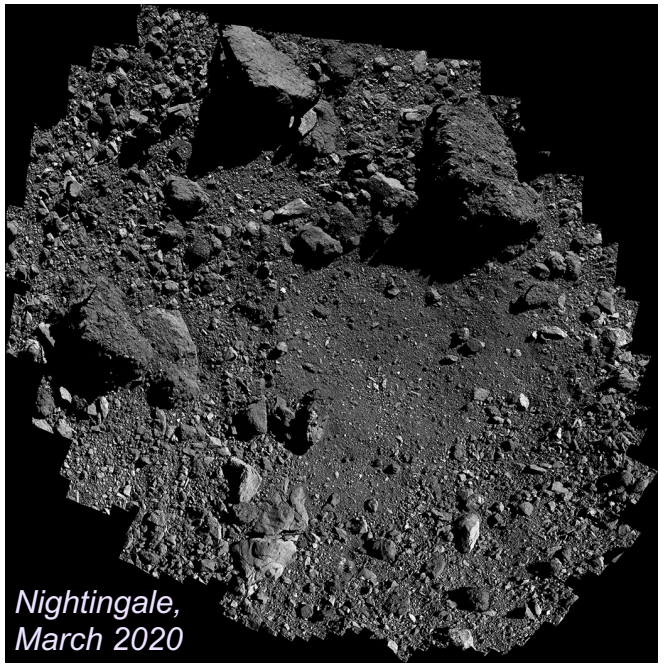
Mars 2020/Perseverance

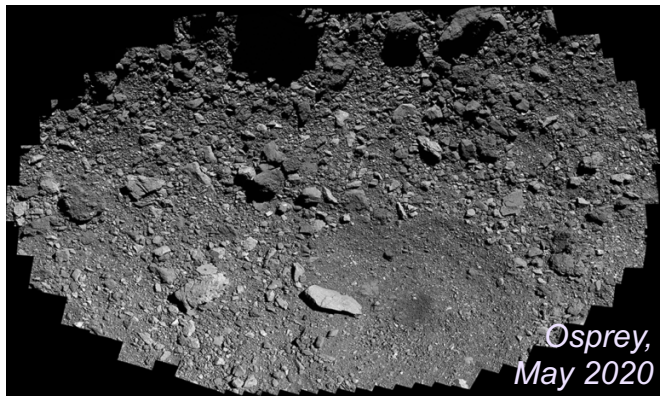




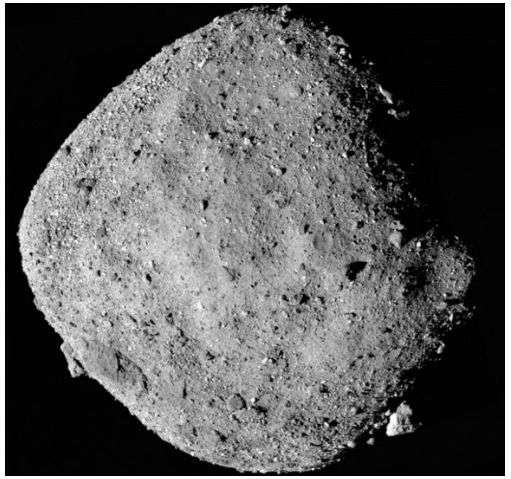
- Successful launch on July 30!
- Will land at Jezero crater on Feb 18, 2021
- *Ingenuity* Mars Helicopter (technology demonstration) will attempt up to five powered, controlled flights
- Virtual launch experience highly successful– some metrics as of July 31:
  - 7.1M social media engagements over launch week
    - #CountdownToMars was trending #2 on Twitter at launch
  - 5M views of launch across all platforms
  - 66.2k virtual participants (Eventbrite)
  - Supported by notable accounts, including: Octavia Spencer, Mae Jemison, Peanuts, Lego, several international space agencies, and 15 members of Congress

OSIRIS-REx


Nightingale, March 2020

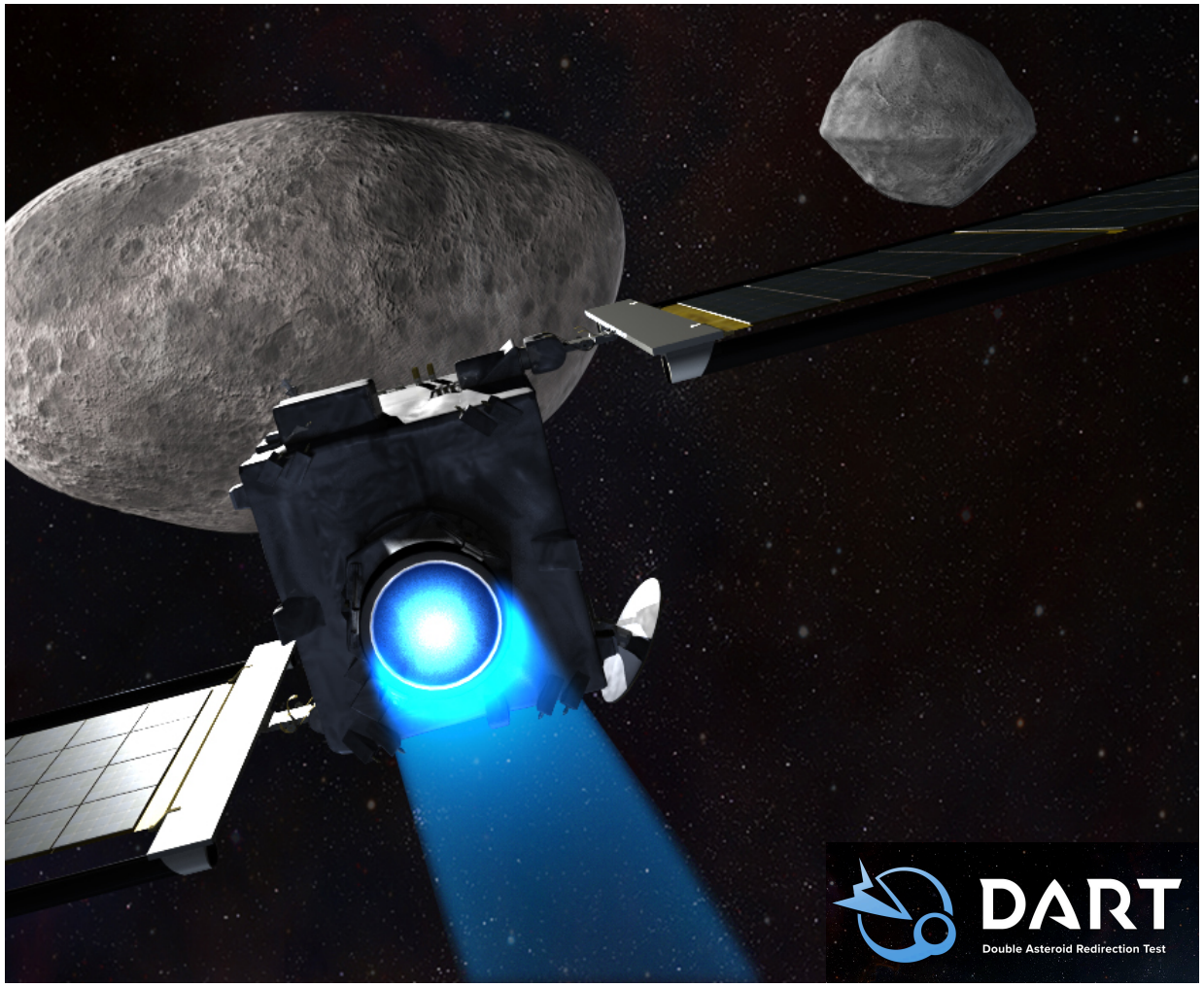

Osprey, May 2020


Matchpoint rehearsal, Nightingale (SamCam)



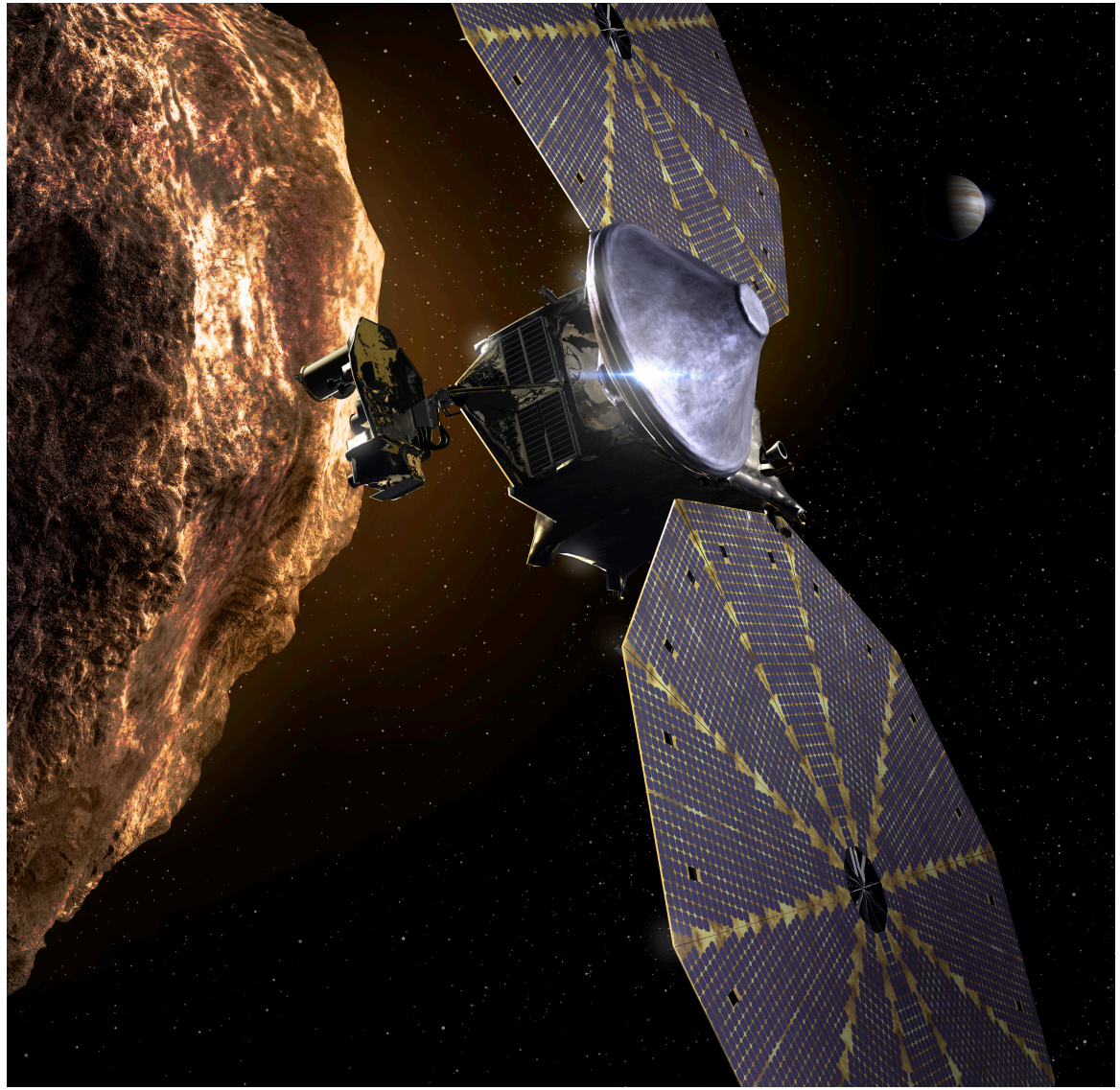
- Spring 2020: Completed recon of primary (Nightingale) and secondary (Osprey) sites
- April 14, 2020: Check point rehearsal – 65 m above surface
- Aug 11, 2020: Matchpoint rehearsal
- Oct 20, 2020: Sampling event (TAG) at Nightingale

Double Asteroid Redirection Test (DART)



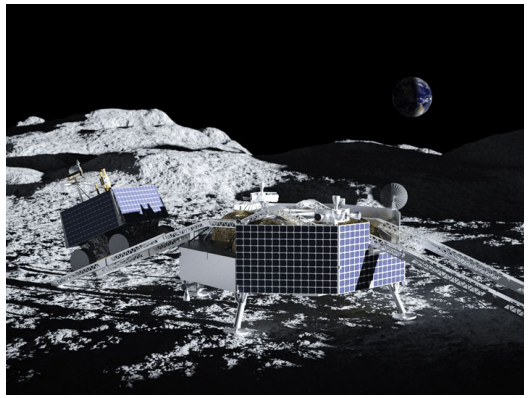
- First mission to demonstrate asteroid deflection technique; first mission from NASA's Planetary Defense Coordination Office
- Kinetic impact will change the motion of an asteroid
- DART target, Dimorphos, will be only 0.07 AU from Earth at impact in October 2022
- ATLO has started; spacecraft core structure is at APL after Covid-19-related shipping delay
- LICIACube manufacturing, integration and test has started; on track for delivery March 2021
- Mission is on track for July 2021 launch aboard a SpaceX Falcon 9
- Participating Scientist Program ROSES Appendix released June 25, Step-2 deadline: Sep 24, 2020

Lucy



- First mission to the Trojan asteroids
- 12 years, 7 flybys, one spacecraft
- Survey the diversity of an unexplored population
- Passed Critical Design Review (CDR) October 2019, and System Integration Review July 2020, KDP-D scheduled for August 25
- ATLO begins in August 2020; work continues with team's health and safety foremost
- HST imaging has revealed a satellite of Eurybates; follow-up HST visits in progress to pin down orbit
- Launch window opens October 2021
- First Trojan flyby August 2027

Volatiles Investigation Polar Exploration Rover (VIPER)



Astrobotic's Griffin Lander selected to deliver VIPER to surface

Rover testing at JSC Rockyard

Science Objectives:

- Characterize distribution and physical state of lunar polar water and other volatiles in lunar cold traps and regolith, to understand their origin
- Provide data and resource maps necessary for NASA to evaluate the potential return of ISRU from lunar polar regions

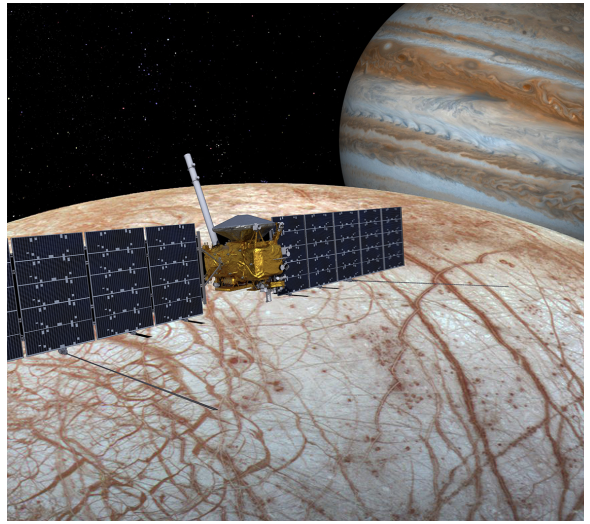
Key Mission Info:

- CLPS (Commercial Lunar Payload Services) lunar delivery by end of 2023
- 100+ Earth-day for 3 lunar day/night cycles
- Instruments: Neutron, Near-IR, and Mass spectrometers; and a 1-m drill

Project Status:

- Astrobotic announced as the CLPS delivery service for VIPER
- VIPER project is progressing toward its Preliminary Design Review (PDR) scheduled for Aug 26–27
    - 17 key subsystem or integrated reviews focusing on preliminary design assessment were completed in advance of PDR

Europa Clipper



Above: Upper cylinder of propulsion module
Top right: Thermal radiator flight unit

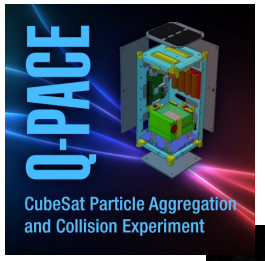
Project Schedule: Final instrument CDR was in June, Project & Flight System CDR will be later this year

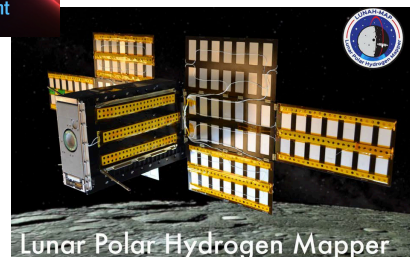
Instrument Cost Control: Steps taken to control cost growth on EIS and MASPEX, including changes to Level 1 requirements

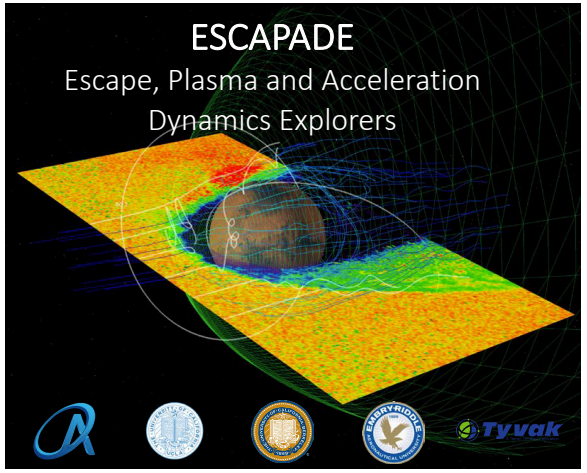
Gravity/Radio Science Team: Competitively selected a team of seven, led by Erwan Mazarico (GSFC), to join the Clipper science team

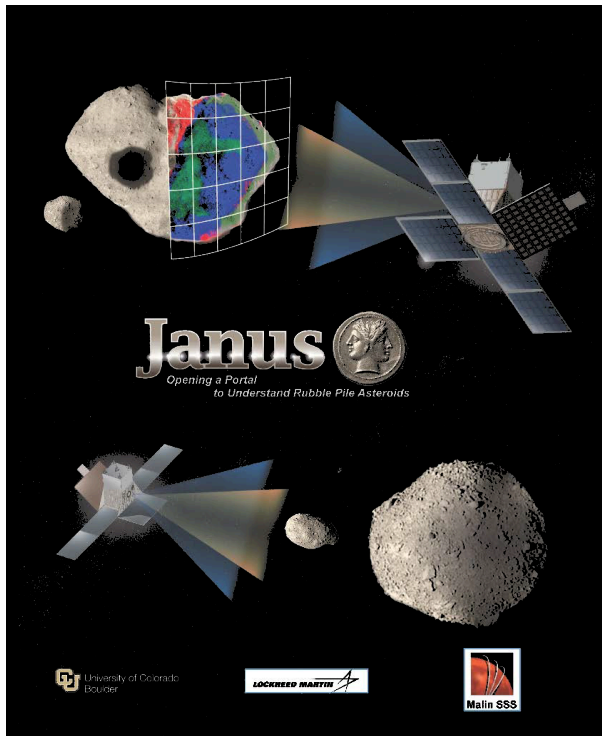
Launch Vehicle: LV uncertainty is an increasing concern; Congress directs use of SLS, but availability before 2025 and its compatibility with Clipper spacecraft is not clear

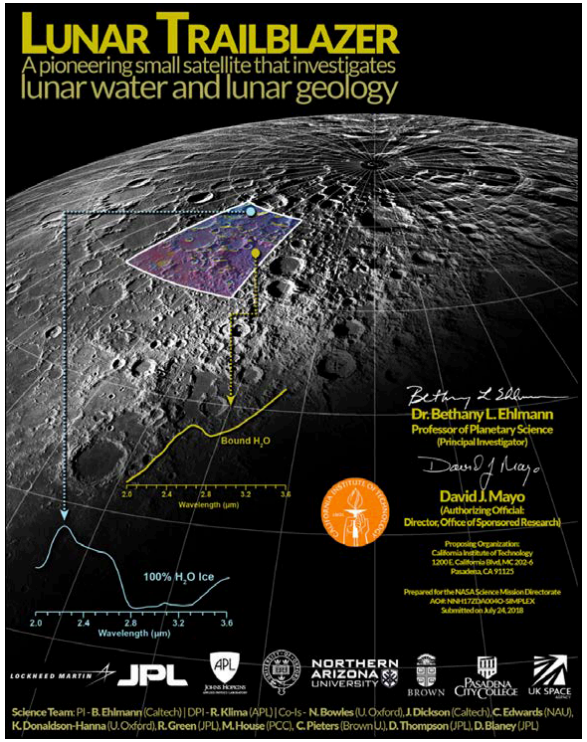
Instrument & Flight System Hardware: Now being built!











SIMPLEx

SIMPLEx-1

Q-PACE:

- Will launch on next flight of Virgin Orbit's LauncherOne (could be as soon as Sept 30)

LunaH-Map:

- Will launch on Artemis-1, NLT Nov 2021
- Delivery required Nov 2020

SIMPLEx-2

Janus:

- PDR held in July; KDP-C will be Sept 3

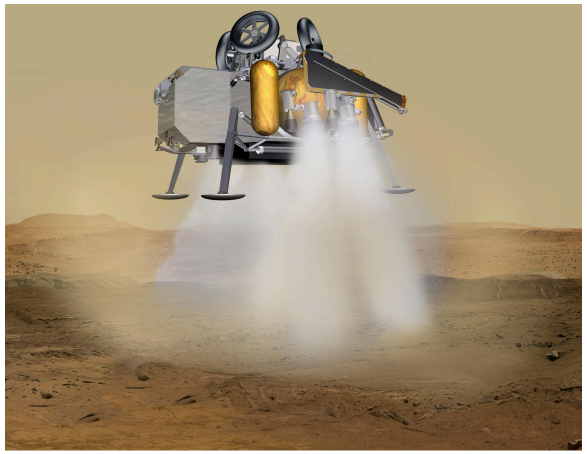
ESCAPADE:

- PDR was Aug 11–13; KDP-C will be Sept 22

Lunar Trailblazer:

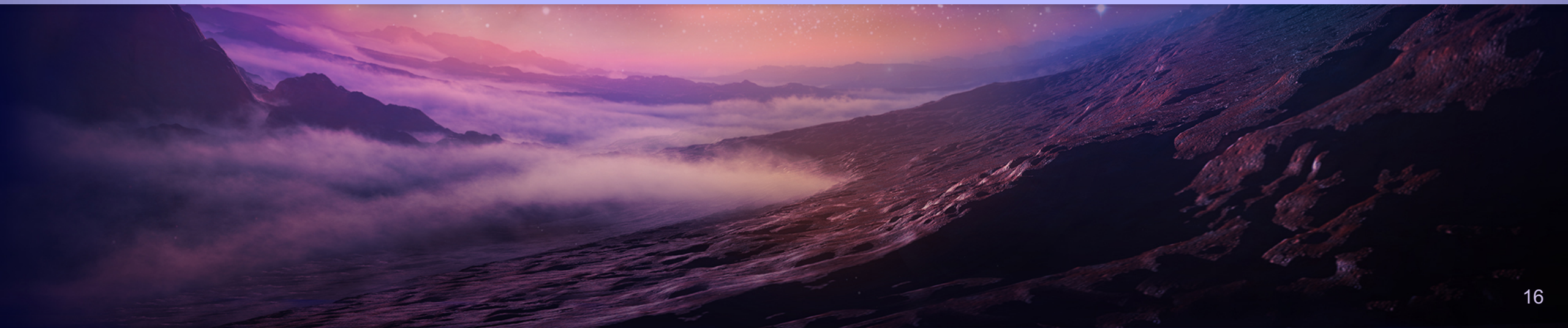
- PDR will be Oct 19; KDP-C will be Nov 24

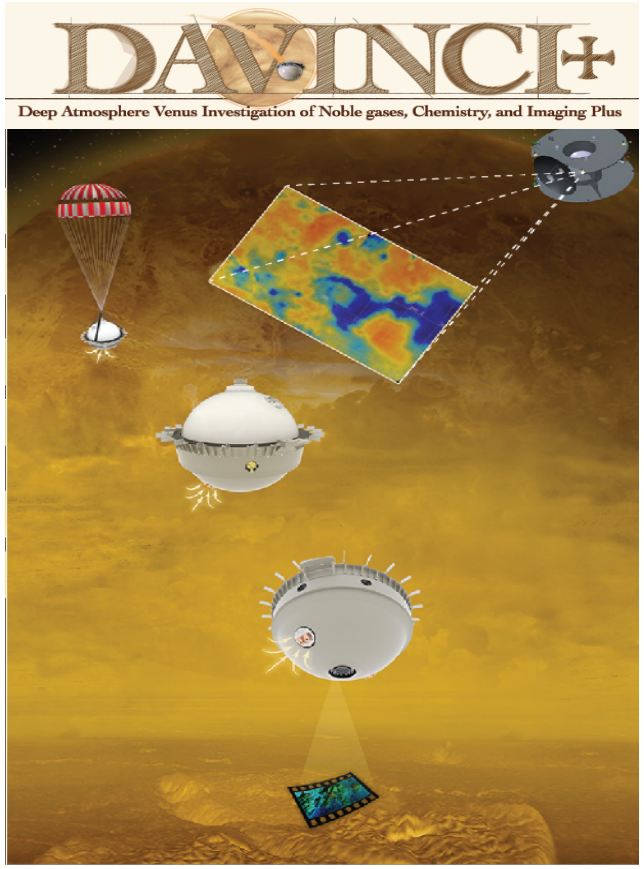
Mars Sample Return

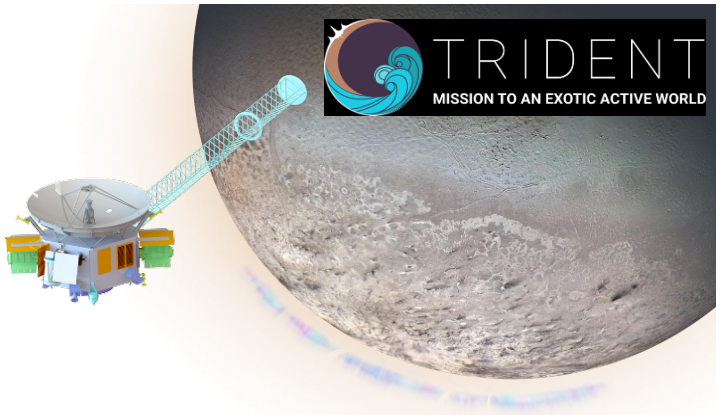


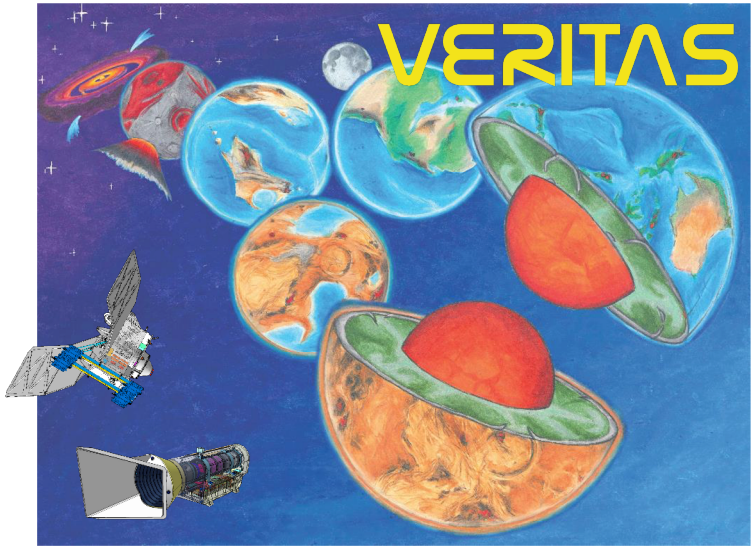
- Mars Sample Return (MSR) MOU approved by ESA Council and is ready for joint NASA/ESA signature
- New Mars Sample Return Program Office Director – **Jeff Gramling**
  - Initiated a review of the MSR Program organization and structure
- A separate, dedicated MSR program office will be established at JPL
  - Will report to MSR Program Director at HQ
  - Will be the system-level ‘project’ organization for MSR
- Michael Meyer will serve as Lead/Chief Scientist for Mars Exploration and MSR
  - Provide the science bridge between the programs
  - Ensure coordination of M2020 surface sampling and caching with MSR
- Mars 2020 Phase-E operations will remain under the Mars Exploration Program, reporting to the Mars Program Manager
- MSR Program will end with the initial containment of the samples (and ERV) at the Earth landing site, per draft Level-1 requirements
- MSR continues to work towards two launches in 2026 (NASA lander + ESA orbiter) and is on track to enter Phase A this Fall

Opportunities









Announcements of Opportunity

New Frontiers #5

- To be released Fall 2022 (current schedule), with community engagement beginning this fall

SIMPLEx-3

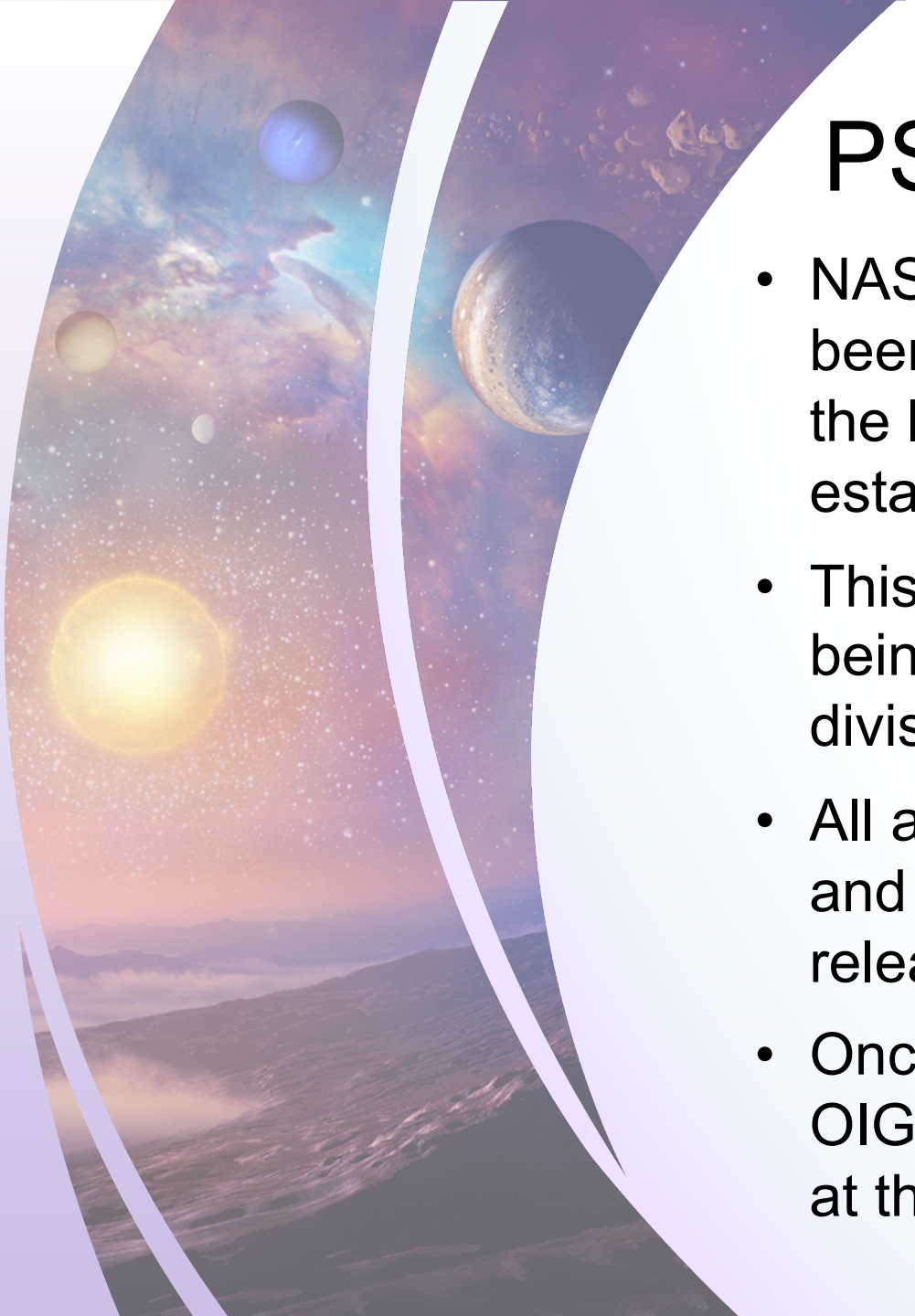
- Release of next opportunity will be NET April 2021

Discovery

- Discovery 2019 remains on schedule, despite COVID-19
- Step-2 Concept Study Reports are due Nov-2019
- Step-2 selections planned for NET April 2021

CAPS New Frontiers report

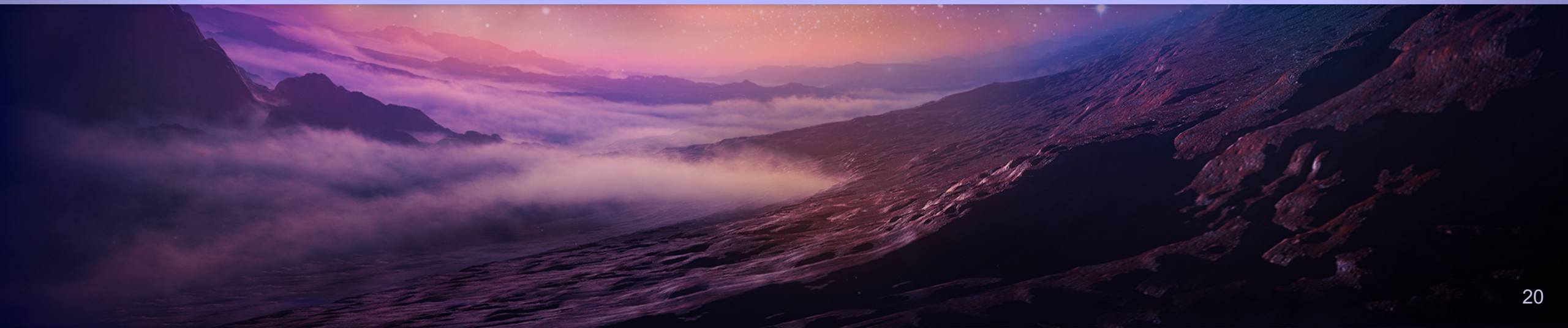
- PSD requested CAPS evaluate changes in scientific understanding and external factors that would warrant reconsidering four of the mission themes for NF5
- Summary of target body findings:
  - Ocean Worlds (Enceladus): retain, since changes in scientific understanding and/or external factors do not warrant reconsideration
  - Ocean Worlds (Titan): remove Titan, since Dragonfly addresses preponderance of the science objectives and for programmatic balance
  - Trojan Tour and Rendezvous: remove, since Lucy addresses the preponderance of the science objectives
  - Io Observer: remove if IVO selected by Discovery, if science objectives remain so similar; retain if not selected by Discovery or science objectives significantly changed
  - Lunar Geophysical Network: retain, since changes in scientific understanding and/or external factors do not warrant reconsideration
- SMD places great weight on the CAPS report and respects their role as the keepers of the Decadal Survey; community announcement coming soon



PSD Portfolio Audit

- NASA's Office of Inspector General (OIG) has been conducting an audit of PSD's portfolio over the last year to examine if the division is meeting established goals and priorities
- This is part of a series of science portfolio audits being conducted by the OIG (Earth and Helio divisions already complete)
- All aspects of the portfolio have been assessed and it is anticipated that OIG's report will be released in the coming months
- Once released, PSD will brief the PAC on the OIG's recommendations and our response plans at the next opportunity

Research and Analysis



Updates

News

- Some funding will be available for grant augmentations and funded extension requests in response to COVID-19
  - See Science Mission Directorate Policy Document SPD-36 and NSPIRES announcements
- Virtual review panels have been going well:
  - **Thank you** to all those who have served (or will do) as reviewers and to our Program Officers for all their work at this difficult time
- Dual Anonymous Peer-Review will be trialed in the Habitable Worlds program for ROSES-20

Upcoming Deadlines

	Step-1 Deadline	Step-2 deadline
DDAP	Aug 28	Oct 30
NFDAP	Sep 3	Nov 5
PICASSO	Sep 18	Nov 20
DART PSP		Sept 24
MDAP	Sep 25	Nov 20

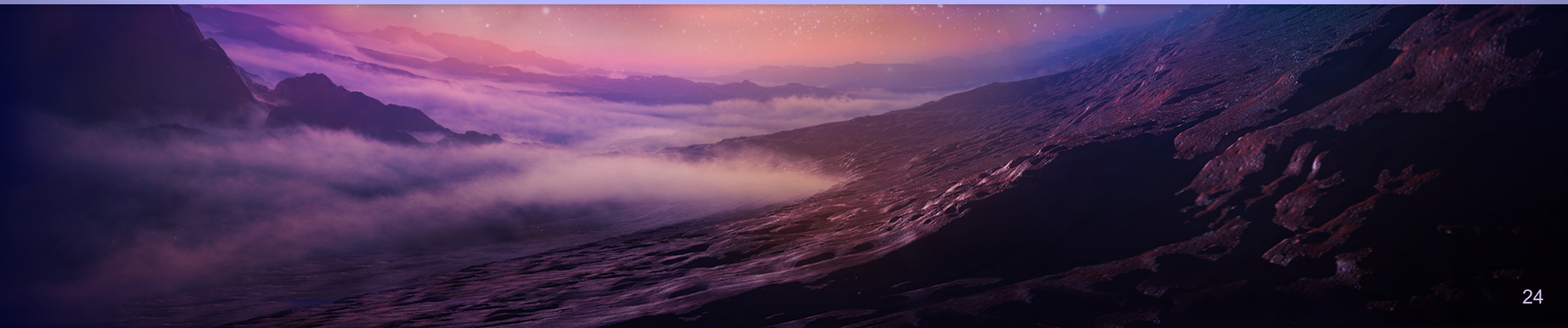
Raising Astrobiology's Profile

- Incorporate astrobiology themes and personnel into the communications strategy, products, and events for PSD missions relating to NASA's study of habitable worlds, the search for life in the universe, and looking into the distribution and delivery of organics in our solar system, including Mars 2020, Europa Clipper, Dragonfly, and OSIRIS REx
- Interface with internal stakeholders (SMD, HEOMD, OCOMM and Agency leadership) to ensure astrobiology is incorporated into mission and thematic content
- Define and implement a digital communications strategy for the Astrobiology program with short- and long-range objectives across multiple centers and missions
- Maintain an active presence on the astrobiology social media accounts to engage learners of all ages and levels of education
- Increase production of astrobiology communications products for the web and social media
- Engage with the astrobiology science community to enhance our communications efforts and highlight the individual faces and stories behind astrobiology

Artemis III

- SMD is formalizing a Science Definition Team (SDT) to define the detailed science objectives of the Artemis III mission
  - Chaired by Dr. Renee Weber, NASA Marshall Space Flight Center and HLS Science Lead
- This is a short-turn-around activity, to provide immediate input to the requirements definition for Artemis formulation and associated hardware development activities
- We will rely heavily on existing community documents (LEAG Lunar Exploration Roadmap, Visions and Voyages, NRC 2007 Report on the Scientific Context for the Exploration of the Moon, and the LEAG Advancing Science of the Moon report)
- We will also be releasing a public call for short (1 to 2 page) white papers, focused on science that can be accomplished with humans at the lunar South Pole
  - Call will go out this week, papers due by 8/31

Decadal Survey and Analysis Groups



Decadal Survey on Planetary Science and Astrobiology

- Co-Chairs announced: **Robin Canup** (SWRI) and **Philip Christensen** (ASU)
  - White Paper deadlines were staggered in response to feedback from community
  - Deadlines are important to ensure that Decadal Survey results can feed into the budget planning cycle
- Planetary Mission Concept Study reports were received and sent to NASEM
  - Science Definition Team reports for VeneraD, Europa Lander, Ice Giants, Mars Ice and Climate Evolution Science Analysis Group and Next Orbiter Science Analysis Group were also sent
- Remaining White Papers (e.g., the state of the profession, infrastructure, interaction with human space exploration, etc) are due **Sept 15**

Notional Timeline for 2023 Decadal Survey

2019	
September	Organizing meeting and town hall at EPSC-DPS
October	Draft statement of task received from NASA
November	LPI launches white paper proposal website
December	Town hall at AGU meeting
2020	
January	National Academies posts Statement of Task
February	Funding proposal to NASA, NSF agree to support
March	Early-career event and town hall at LPSC
Spring	White paper submission begins, chair announced
Summer	White paper deadline and meetings begin
2021	
Autumn	Complete draft of survey report assembled
2022	
Spring	Survey report released, dissemination starts
2023	End of dissemination/NASA contract

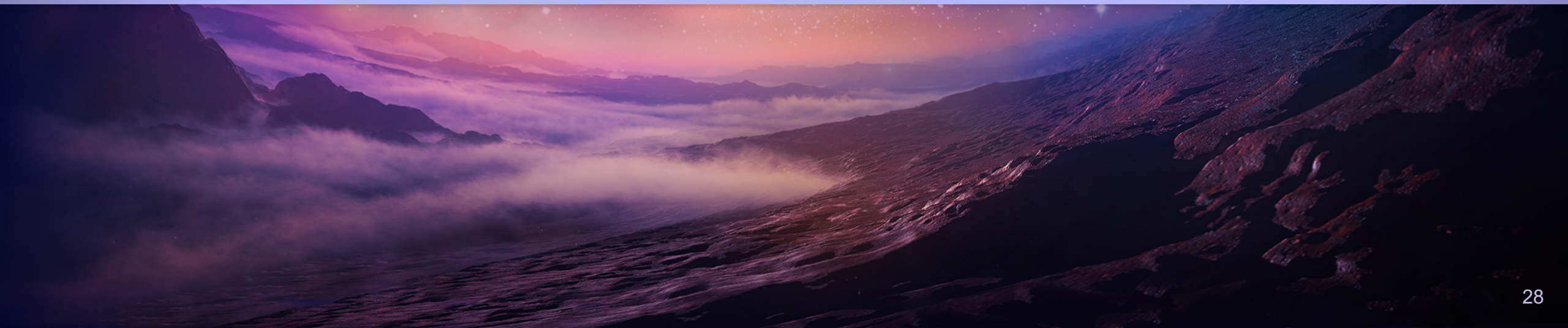
Assessment/Analysis Group Updates

- Terms of Reference (also known as Charters) for all the AGs have been updated and broadly standardized
  - CAPTEM TOR currently being updated to change its function to be more consistent with the other AGs
  - Sample allocation reviews will be conducted independently of CAPTEM
- The **Mercury Exploration Assessment Group** (MExAG) has been stood up
  - Chair: Steven A. Hauck II (Case Western Reserve University)
  - Steering Committee formed
  - Details: https://www.lpi.usra.edu/mexag/
  - NASA Liaison: Shoshana Weider

Upcoming AG meetings

- OPAG: Sept 1–3
- LEAG: Sept 14–16
- CAPTEM special meeting: Sept
- VEXAG: Nov 16–17

Response to March 2020 Findings



Finding 1: Europa Clipper Launch Vehicle

Finding: In 2016, Congress mandated that the Europa Clipper mission must launch on the Space Launch System (SLS). Given that schedule and cost concerns with the SLS are driving NASA to consider using an alternate launch vehicle, the Europa Clipper design must accommodate two different launch vehicles. The PAC finds that the potentially significant costs associated with maintaining compatibility with two different launch vehicles should be identified. Furthermore, the PAC finds that every effort should be made to avoid allowing these costs to impact the mission's ability to meet its science objectives regardless of which launch vehicle is eventually chosen.

NASA Response: The additional cost associated with carrying a second launch vehicle compatibility has not been determined at a precise level, but the rate of total cost impact to date has been estimated by the project to be approximately $30 million per year, so far. However, as the project transitions from design into fabrication, the accumulation of additional cost will rapidly accelerate as Clipper hardware is developed that is unique to the launch vehicle. Both of the launch vehicles currently under consideration are capable of delivering the Clipper spacecraft to the intended target interface point, and placing the spacecraft into the desired Jovian tour orbit. The utilization of either launch vehicle under consideration will permit the Europa Clipper mission to complete all Level 1 mission objectives.

Finding 2: New Frontiers

Finding: The PAC strongly endorses the importance of the upcoming review by the National Academies of Sciences, Engineering and Medicine (NASEM) Committee on Astrobiology and Planetary Science (CAPS) of the slate of missions for NASA's New Frontiers 5 Announcement of Opportunity. However, the PAC recognizes that the optimal methodologies to pursue the science objectives for any given New Frontiers priority investigation may have evolved since they were prioritized in the NASEM's last Planetary Science Decadal Survey and the changes in these optimal methodologies may not have been captured by the NASEM's recent mid-term review.

NASA Response: NASA recognizes that methodologies not only evolve but are as varied as the imagination of the proposers. This is why the New Frontiers 4 AO explicitly stated that only the science objectives, not the method in which they are accomplished, are dictated by the AO. Proposers were free to pursue any mission implementation they liked, as long as it achieved the preponderance of the science objectives provided in the AO. The same approach will be followed for New Frontiers 5.

Finding 3: WFIRST

Finding: Great benefits for Solar System science have been achieved via remote sensing with NASA's Astrophysics Division (APD) missions (e.g., the Great Observatories). Software to allow these space telescopes to track moving targets has been key for enabling this science. As of this writing, moving target tracking has been removed from the APD's WFIRST mission, despite the presence of this capability on most Astrophysics missions to date. The PAC finds a need for information from the APD and/or the WFIRST project about the status of this capability and possibilities for including it. The PAC also finds that it would be prudent for SMD to consider whether this capability should be made standard for space telescope missions, to avoid having to revisit the question for each flight project at added cost and effort.

NASA Response: Short answer: simply adding back moving target tracking is not valuable. It also requires additional upgrades to the instrument payload; the cost of which would break the Agency cap.

Long answer: The cost of Roman (formerly WFIRST) is capped at an Agency commitment of $3.2B, as well as Senate language and the commitment to stakeholders. There was an independent review of Roman (WIETR) in 2017 (https://www.nasa.gov/sites/default/files/atoms/files/wietr_final_report_101917.pdf) that recommended descopes to maintain the mission's cost cap. First, the Integral Field Channel (IFC) spectrometer that was part of the original Wide Field Instrument (WFI) scope and that was a basis for the science presented in the 2018 solar system science with WFIRST paper (doi:10.1117/1.JATIS.4.3.034003) was removed. The IFC was replaced with the two slitless spectroscopy modes. Second, the moving target tracking also was descoped from the mission at that time in recognition of cost savings. The solar system working group for Roman (WFIRST) looked into the science enabled through slitless spectroscopy and determined that **even with** moving target tracking, there was little (if any) scientific gain with respect to other facilities. It also is important to note that any contribution from PSD must ***still*** stay within the NASA $3.2B development cost cap, meaning that a PSD contribution decreases the amount of reserves APD can hold to offset future risks.

Finding 4: ISFM

Finding: The PAC finds that the philosophy and implementation of NASA's Internal Scientist Funding Model (ISFM), now in its third year, remains unclear and has not been sufficiently communicated to the planetary community. Per the PAC's July, 2018 findings, the implementation of this new approach to supporting science at NASA centers must be done in a transparent manner. Clear standards and metrics are necessary to evaluate whether the new approach is successful in maximizing scientific return to NASA per research dollar. The PAC finds that NASA should present the standards for success and performance metrics of the first two years of the ISFM at the next PAC meeting to mitigate this lack of transparency. These metrics should include, e.g., how the ISFM has affected the number of submitted ROSES proposals, the fraction of the overall R&A budget now allocated through the ISFM vs. through standard peer review, community service activities being undertaken by ISFM-supported scientists, metrics to assess ISFM scientific productivity and early career scientist involvement, and planned review standards for continuation and level of future ISFM allocations.

NASA Response: We have carried out the first review of the ISFMs. An external panel of community scientists was convened, and detailed reviews of the ISFM progress reports were carried out; overall, the reviews were very positive about the scientific productivity of the ISFMs. We still are digesting all of the information we received from the reviewers, and plan on having an overall summary very soon. In addition, we are doing an internal programmatic review to assess how the ISFMs are meeting the non-scientific objectives (reduced number of proposals, etc). We have seen a substantial reduction in the number of proposals from the Centers, and increased participation in reviews by Civil Servant scientists, but detailed analysis is still underway.

Finding 5: Planetary Data Ecosystem

Finding: The PAC applauds the innovative and useful efforts by the Planetary Science Division to define a Planetary Data Ecosystem. Their efforts to communicate the concepts behind, and importance of, a Planetary Data Ecosystem will significantly improve the discoverability and usability of high-level data products from NASA planetary spacecraft missions. The PAC recommends that these efforts continue to receive full support and maintain a high level of visibility with respect to the NASA Planetary Science Division.

NASA Response: SMD and PSD leadership are fully supportive of improving the discoverability and usability of data products from NASA planetary spacecraft missions and research. In the near-term, PSD is soliciting community feedback on the Planetary Data Ecosystem (PDE) through a Request for Information. Additionally, a PDE Independent Review Board (IRB) will be stood up in Fall 2020 to conduct a wholistic review of PSD's PDE, with the goal of defining the full environment, identifying missing or redundant elements, and providing findings and prioritized, actionable recommendations for PSD's long-term planning in support of the PDE. A self-nomination form has been published for community members interested in serving on the PDE IRB. In the long-term, NASA envisions a PDE that works to meet four strategic goals.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